

## SCIENCE:

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JOHN MICHELS, Editor.

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## TO OUR ENGLISH READERS.

We have received from Messrs. Deacon & Co., of 150 Leadenhall street, London, England, a standing order for a large supply of "SCIENCE," which will be forwarded weekly. We shall be obliged if our English readers will make this fact known to their friends.

THE REVELATIONS OF THE AUTOPSY HELD  
ON THE BODY OF THE LATE PRESIDENT.

THE *Medical Record* of October 8th contains an account by Dr. Bliss, the late President's attending surgeon, of the life history of his illustrious patient, as well as the *post mortem* observations recorded at the time of the autopsy, and also at a later period, by those who examined the specimens preserved in the Army Medical Museum.

Inasmuch as the various diagnoses, made during Mr. Garfield's life, as to the location of the bullet, and the injury sustained by various organs, were all of them erroneous, and as the secular and medical journals have already discussed those topics *ad nauseam*, we shall limit ourselves to a relation of the leading features in the light of the anatomical findings.

For similar reasons, we shall give no space to a discussion of the views expressed by a physician, who, after incurring considerable ridicule at the hands of the medical profession, and much obloquy at the hands of the public, on account of his sensational experiments on dead bodies, and whose claimed results no doubt misled the eminent surgeons at the President's bed-side, publishes a *post mortem* diagnosis of the case in the same issue of the *Record*. In it he seeks to prove that if the bullet *was* found in an entirely different locality from the one his experiments induced him to surmise, it *would*, had it

have gone a little further, infallibly have dropped into a similar situation on the *opposite* side! One of the leading medical journals has no other comment to make on this performance, and, as far as we can learn, that comment expresses the general opinion of the medical profession, than to announce that a leading circus company has engaged the services of Dr. Fanueil D. Weisse to repeat his celebrated experiments in the course of the programme.

We subjoin the essential portions of Dr. Bliss' report:—

The depressed cicatrix of the wound made by the pistol-bullet was recognized over the tenth intercostal space, three and one-half inches to the right of the vertebral spines. A deep linear incision (made in part by the operation of July 24, and extended by that of August 8) occupied a position closely corresponding to the upper border of the right twelfth rib. It commenced posteriorly about two inches from the vertebral spines, and extended forward a little more than three inches. At the anterior extremity of this incision there was a deep, nearly square abraded surface about an inch across.

On inspection of the abdominal viscera *in situ*, the transverse colon was observed to lie a little above the line of the umbilicus. It was firmly adherent to the anterior edge of the liver. The greater omentum covered the intestines pretty thoroughly from the transverse colon almost to the pubes. It was still quite fat, and was very much blackened by venous congestion. On both sides its lateral margins were adherent to the abdominal parietes opposite the eleventh and twelfth ribs. On the left side the adhesions were numerous, firm, well organized and probably old.

These adhesions, and the firm ones on the right side, as well as those of the spleen, possibly date back to an attack of chronic dysentery, from which the patient is said to have suffered during the civil war. On the right side there were a few similar adhesions, and a number of more delicate and probably recent ones.

A mass of black, coagulated blood covered and concealed the spleen and the left margin of the greater omentum. On raising the omentum it was found that this blood-mass extended through the left lumbar and iliac regions and dipped down into the pelvis, in which there was some clotted blood and rather more than a pint of bloody fluid. The blood-coagula having been turned out and collected, measured very nearly a pint. It was now evident that secondary hemorrhage had been the immediate cause of death, but the point from which the blood had escaped was not at once apparent.

The adhesions between the liver and the transverse colon proved to bound an *abscess-cavity* between the under-surface of the liver, the transverse colon, and the transverse mesocolon, which involved the gall-bladder, and extended to about the same distance on each side of it, measuring six inches transversely and four inches from before backward. This cavity was lined by a thick pyogenic membrane, which completely replaced the capsule of that part of the undersurface of the liver occupied by the abscess. It contained

about two ounces of greenish yellow fluid—a mixture of pus and biliary matter. This abscess did not involve any portion of the substance of the liver except the surface with which it was in contact, and no communication could be detected between it and any part of the wound.

Some recent peritoneal adhesions existed between the upper surface of the right lobe of the liver and the diaphragm. The *liver* was larger than normal, weighing eighty-four ounces; its substance was firm, but of a pale yellowish color on its surface and throughout the interior of the organ, from fatty degeneration. No evidence that it had been penetrated by the bullet could be found, nor were there any abscesses or infarctions in any part of its tissue.

The *spleen* was connected to the diaphragm by firm, probably old, peritoneal adhesions. There were several rather deep congenital fissures in its margins, giving it a lobulated appearance. It was abnormally large, weighing eighteen ounces; of a very dark lake-red color both on the surface and on section. Its parenchyma was soft and flabby, but contained no abscesses or infarctions.

There were some recent peritoneal adhesions between the posterior wall of the *stomach* and the posterior abdominal parietes. With this exception no abnormalities were discovered in the stomach or *intestines*, nor were any other evidences of general or local peritonitis found besides those already specified.

The *right kidney* weighed six ounces, the *left kidney* seven. Just beneath the capsule of the left kidney, at about the middle of its convex border, there was a little abscess one-third of an inch in diameter, and there were three small serous cysts on the convex border of the right kidney, just beneath the capsule; in other respects the tissue of both kidneys was normal in appearance and texture.

The *urinary bladder* was empty.

Behind the right kidney, after the removal of that organ from the body, the dilated *track of the bullet* was dissected into. It was found that from the point at which it had fractured the right eleventh rib (three and one-half inches to the right of the vertebral spines) that missile had gone to the left, obliquely forward, passing through the body of the first lumbar vertebra and lodging in the adipose connective tissue immediately below the lower border of the pancreas, about two and one-half inches to the left of the spinal column, and behind the peritoneum. It had become completely encysted.

The track of the bullet between the point at which it had fractured the eleventh rib and that at which it entered the first lumbar vertebra was considerably dilated, and the pus had burrowed downward through the adipose tissue behind the right kidney, and thence had found its way between the peritoneum and the right iliac fascia, making a descending channel which extended almost to the groin. The adipose tissue behind the right kidney, and thence had found its way between the peritoneum and the right iliac fascia, making a descending channel which extended almost to the groin. The adipose tissue behind the kidney in the vicinity of this descending channel was much thickened and condensed by inflammation. In the channel, which was almost free from pus, lay the flexible catheter introduced into the wound at the com-

mencement of the autopsy; its extremity was found doubled upon itself, immediately beneath the peritoneum, reposing upon the iliac fascia, where the channel was dilated into a pouch of considerable size. This long descending channel, now clearly seen to be caused by the burrowing of pus from the wound, was supposed, during life, to have been the track of the bullet.

The last dorsal, together with the first and second lumbar vertebra and the twelfth rib, were then removed from the body for more thorough examination.

When this examination was made, it was found that the bullet had penetrated the first lumbar vertebra in the upper part of the right side of its body. The aperture by which it entered involved the intervertebral cartilage next above, and was situated just below and anterior to the intervertebral foramen, from which its upper margin was about one-fourth of an inch distant. Passing obliquely to the left, and forward through the upper part of the body of the first lumbar vertebra, the bullet emerged by an aperture, the centre of which was about one-half inch to the left of the median line, and which also involved the intervertebral cartilage next above. The cancellated tissue of the body of the first lumbar vertebra was very much comminuted and the fragments somewhat displaced. Several deep fissures extended from the track of the bullet into the lower part of the body of the twelfth dorsal vertebra. Others extended through the first lumbar vertebra into the intervertebral cartilage between it and the second lumbar vertebra. Both this cartilage and that next above were partly destroyed by ulceration. A number of minute fragments from the fractured lumbar vertebra had been driven into the adjacent soft parts.

It was further found that the right twelfth rib also was fractured at a point one and one-fourth inch to the right of the transverse process of the twelfth dorsal vertebra; this injury had not been recognized during life.

On sawing through the vertebra, a little to the right of the median line, it was found that the spinal canal was not involved by the track of the ball. The spinal cord, and other contents of this portion of the spinal canal, presented no abnormal appearances. The rest of the spinal cord was not examined.

Beyond the first lumbar vertebra, the bullet continued to go to the left, passing behind the pancreas to the point where it was found. Here it was enveloped in a firm cyst of connective tissue, which contained, besides the ball, a minute quantity of inspissated, somewhat cheesy pus, which formed a thin layer over a portion of the surface of the lead. There was also a black shred adherent to a part of the cyst-wall, which proved, on microscopical examination, to be the remains of a blood-clot. For about an inch from this cyst the track of the ball behind the pancreas was completely obliterated by the healing process. Thence, as far backward as the body of the first lumbar vertebra, the track was filled with coagulated blood, which extended on the left into an irregular space rent in the adjoining adipose tissue behind the peritoneum and above the pancreas. The blood had worked its way to the left, bursting finally through the peritoneum behind the spleen into the abdominal cavity. The rending of the tissues by the

extravasation of this blood was undoubtedly the cause of the paroxysms of pain which occurred a short time before death.

This mass of coagulated blood was of irregular form, and nearly as large as a man's fist. It could be distinctly seen from in front through the peritoneum, after its site behind the greater curvature of the stomach had been exposed by the dissection of the greater omentum from the stomach, and especially after some delicate adhesions between the stomach and the part of the peritoneum covering the blood-mass had been broken down by the fingers. From the relations of the mass as thus seen, it was believed that the hemorrhage had proceeded from one of the mesenteric arteries, but as it was clear that a minute dissection would be required to determine the particular branch involved, it was agreed that the infiltrated tissues and the adjoining soft parts should be preserved for subsequent study.

On the examination and dissection made in accordance with this agreement, it was found that the fatal hemorrhage proceeded from a rent, nearly four tenths of an inch long, in the main trunk of the splenic artery, two and one-half inches to the left of the celiac axis. This rent must have occurred at least several days before death, since the everted edges in the slit in the vessel were united by firm adhesions to the surrounding connective tissue, thus forming an almost continuous wall bounding the adjoining portion of the blood-clot. Moreover, the peripheral portion of the clot in this vicinity was disposed in pretty firm concentric layers. It was further found that the cyst below the lower margin of the pancreas, in which the bullet was found, was situated three and one-half inches to the left of the celiac axis.

Besides the mass of coagulated blood just described, another, about the size of a walnut, was found in the greater omentum, near the splenic extremity of the stomach. The communication, if any, between this and the larger hemorrhage mass could not be made out.

The examination of the *thoracic viscera* resulted as follows:

The *heart* weighed eleven ounces. All the cavities were entirely empty except the right ventricle, in which a few shreds of soft, reddish, coagulated blood adhered to the internal surface. On the surface of the mitral valve there were several spots of fatty degeneration; with this exception the cardiac valves were normal. The muscular tissue of the heart was soft, and tore easily. A few spots of fatty degeneration existed in the lining membrane of the aorta just above the semilunar valves, and a slender clot of fibrin was found in the aorta, where it was divided, about two inches from these valves, for the removal of the heart.

On the right side slight pleuritic adhesions existed between the convex surface of the lower lobe of the lung and the costal pleura, and firm adhesions between the anterior edge of the lower lobe, the pericardium, and the diaphragm. The *right lung* weighed thirty-two ounces. The posterior part of the fissure,

between its upper and lower lobes, was congenitally incomplete. The lower lobe of the right lung was hypostatically congested, and considerable portions, especially toward its base, were the seat of broncho pneumonia. The bronchial tubes contained a considerable quantity of stringy muco-pus; their mucous surface was reddened by catarrhal bronchitis. The lung-tissue was oedematous, but contained no abscesses or infarctions.

On the left side the lower lobe of the lung was bound behind to the costal pleura, above to the upper lobe, and below to the diaphragm, by pretty firm pleuritic adhesions. The *left lung* weighed twenty-seven ounces. The condition of the bronchial tubes and of the lung-tissue was very nearly the same as on the right side, the chief difference being that the area of the broncho-pneumonia in the lower lobe was much less extensive in the left lung than in the right. In the lateral part of the lower lobe of the left lung, and about an inch from its pleural surface, there was a group of four minute areas of gray hepatization, each about one-eighth of an inch in diameter. There were no infarctions and no abscesses in any part of the lung-tissue.

The surgeons assisting at the autopsy were unanimously of the opinion that, on reviewing the history of the case in connection with the autopsy, it is quite

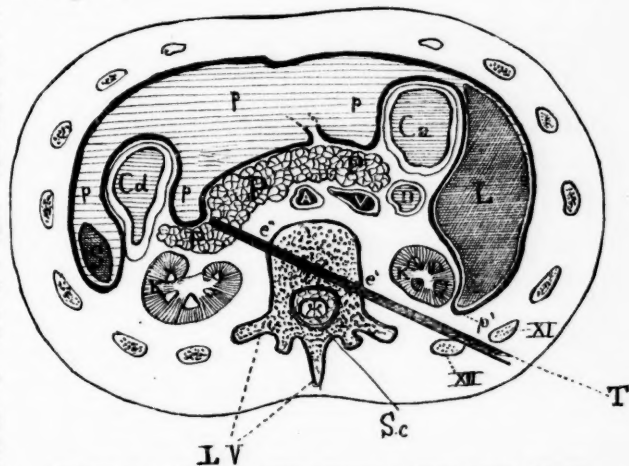


DIAGRAM OF A HORIZONTAL SECTION THROUGH A FROZEN HUMAN CADAVER AT THE LEVEL OF THE PANCREAS.

evident that the different suppurating surfaces, and especially the fractured spongy tissue of the vertebra furnish a sufficient explanation of the septic conditions which existed during life.

The accompanying diagrams (page 503) from the *Medical Record* illustrate the course of the bullet very aptly. Fig. 6 is, in our opinion, valueless as a diagram, and it is difficult to harmonize the statements about the track of the ball, and the figure reference, "injury to artery" in the latter illustration. The figure reference, "Point of impact of ball and deflection," may be also taken with some allowance.

We have added a schematic drawing taken from a plate representing a frozen section through the human

body, in the horizontal plane (supposing the body standing), and figured of the life size in Braune's magnificent "Atlas." Such a diagram more accurately represents the course of the bullet topographically, than the ones selected by Dr. Bliss seem to us to do.

It is a noteworthy fact, that on marking the topographical projection of the fracture of the 11th rib, that is the point of impact (XI), the fracture of the 12th rib (XII), the aperture of entry into the lumbar vertebra (c'), the aperture of exit (c''), and the terminus of the bullet track, where the bullet was found encysted, on this frozen section, and *connecting all these points by a line, that line is found to be perfectly straight!* It will be seen on examining the figures 4 and 5 furnished by the President's physician, that the bullet track was as straight as an arrow in its frontal projection, and as far as it involved the bony structures.

Now, a line which appears as a straight line in two projections of space, is a straight line in fact, and from this point of view, the case merits renewed discussion.

It must be recollected that our diagram represents a horizontal plane of the body, and the one where the bullet was found encysted. The point of impact lies much higher, the liver in that higher level occupies a greater area of the section, and the bullet in passing the peritoneum seems to have grazed the latter. It could hardly have done so without "nicking" the lower part of the pleural cavity, which descends to this level as a fine slit. The pleuritic adhesions found at the lower part of the right lung, sustain this view.

In the light of modern surgery, an examination of this wound could have presented no difficulties. It is illustrative of the unfortunate position in which the President's physicians find themselves placed, when attempting to defend their course, that the only examination of the wound, which they are able to refer to, is that made by the Surgeon General of the Navy, who was checked in his examination, and excluded from the President's bed-side by those later in charge of the patient. That the fracture of the ribs was not recognized by the attendants, until suppuration near the point of impact necessitated the removal of dead and decaying fragments of bone, is also a remarkable feature of the case. The course of the bullet from the point of impact, being a direct one to the lumbar vertebra, it is difficult to conceive how a thorough digital and instrumental examination could have failed to detect the irregularity produced on the vertebral body by the entrance of the bullet.

None of the procedures necessary to have determined the bullet track from the point of impact to the point of entry into the spinal column, would have been unwarrantable to the most conservative surgeon.

*None of these procedures would have been more risky than the one later resorted to in the case, when the false bullet track was repeatedly probed to a distance of twelve inches.*

At this point criticism must necessarily pause, with reference to the question of the examination of the wound. The perforation of the lumbar vertebra having been detected, a bold surgeon might shrink from passing his probe further and following up the bullet-track into the regions beyond, through a perforated segment of the spinal column. What now, in the light of the *post mortem* seems perfectly feasible, during the President's life would have been considered as "heroic" a surgery, as can well be conceived. That a surgeon endowed with the necessary amount of daring, and that great essential the *tactus eruditus*, could have passed a probe through the vertebra and touched the bullet, *without injuring any important organ*, must be admitted by every impartial expert who bears in mind the directness of the bullet track.

This question, however, represents rather a side-issue, when it is recollected that it was not the location of the ball, or its presence in the body, that killed the President. It is only as an illustration of the extent to which the public was misled, and we fear intentionally misled, by some of the President's physicians, that it merits being referred to.

One of the consulting surgeons stated in an ironical way that the bullet could have been removed if its situation had been known, provided the surgeon had, as a preliminary, removed several lumbar vertebrae, and groped his way among the great nerves, the thoracic duct, the Aorta and the Vena Cava. This assertion is stated by no less a one than Dr. Hammond, to be an intentional deception of the people, as it was made through the columns of the daily papers. The reader will see in our diagram that the Aorta and Vena Cava have absolutely no relations to the bullet-track or to the seat of the bullet. Had the situation of the latter been appreciated during life, an incision on the left side of the spinal column would have been in order. This incision and the entire operation *would have been the strict counterparts of certain of the legitimate operations of modern surgery, namely of nephrotomy and lumbo-colotomy.* It is bad surgery which insists that in every bullet wound, the bullet has to be extracted through its own track. A bullet perforating the thigh to within an inch of the surface on the other side, is to be extracted from the point where it is nearest the surface.

The reader will find the left kidney indicated at K, this is operated on in the operation of nephrotomy, he will find the descending colon at (C. d.), this is opened into in the operation of lumbo-colotomy;

The same risks would have to be taken in the extraction of the bullet that are familiar to the surgeon who performs the latter operation.

Leaving aside all speculative issues, let us trace out the symptoms of the heroic and patient sufferer and their basis, as inferable from the autopsy.

When first struck by the bullet, the President suffered from Surgical Shock. The wound was so severe that his death might have taken place in a few hours; death so occurs to soldiers on the field of battle, who receive similar wounds. His treatment, which consisted in the administration of stimulants and opium, was eminently proper, and doubtless aided by the powerful constitution, overcame the tendency to a fatal collapse.

A tendency to such a collapse recurred at a later period, when Dr. Wales thought the President dying. The primary hemorrhage from the wound was insignificant, no important blood vessels were injured, and the hemorrhage seems to have been mainly external. At a later period an escape of dark venous blood from the wound seems to us to have indicated necrotic usure of the large veins running in the substance of the injured vertebral body.

The painful sensations experienced in the distribution of all the nerves, originating from the crural and particularly the sacral plexus, are attributable to the sudden shock acting on the vertebral column. There is no evidence that any hemorrhage occurred around the nerve roots, or any inflammatory disturbance of the cord or its membranes. The spontaneous disappearance of these nervous symptoms proves conclusively that they were due to the kind of shock, frequently occurring in the practice of military surgeons, and well described by Mitchell, Morehouse and Keene in their work on nerve-injuries. That the nerves on the right side suffered more than those of the left, is attributable to the greater nearness of the right vertebral bullet aperture to the inter-vertebral foramen, where the nerves concerned in the tegumentary supply of the most painful region in this case emerge.

The main injury done by the bullet in its further course, consisted in the irritation of important nerve filaments connected with the Solar Plexus of the Sympathetic System. Irritation of this Plexus, or its derivative branches, accounts for the obstinate and frequently recurring spells of nausea and vomiting, as well as for the great acceleration of the pulse rate, so marked a feature of the President's history. These same symptoms, through the same mechanism, occur with peritonitis, and some of our best physicians suspected the existence of this trouble, from these two symptoms alone. It cannot be said that the imperfect and ambiguous post-mortem record quoted,

proves them to have been wrong in their surmise.

In view of the great irritability of the alimentary canal, it is to be considered highly unfortunate that the President's dietary was not properly attended to. At least two of his relapses were due to the undue massing of food in his stomach, at what were considered convalescent periods. Though it is denied that he was allowed improper articles, yet in view of the fact that much of what occurred in the sick-chambers, was rigidly ignored or suppressed by the medical staff, and that on their own confession he was fed on so injurious a combination as milk and lemon-juice for the first few days after the injury, we can not consider that assertion as an invention, until a more authoritative denial be made, than the one vouchsafed by Dr. Bliss.

Several days after the injury, when that examination of the wound was made, which should, in the opinion of ninety-nine out of a hundred surgeons, whom we have consulted or heard opinions from, been made in the first place, a canal was found extending downward to the pelvis. This is now known as the fistulous tract represented on the body-diagram. It was due to burrowing of the pus originating, be it borne in mind, not from the bullet, not from the perforated vertebra, but from the neglected fragments of the eleventh rib. The surgeons did all in their power for a long period to oppose Nature's attempt to close this passage. Thus the pus-absorbing surfaces were largely increased, and with it the dangers of pyæmia.

Without entering into the details of the management of the case, let us conclude with an examination as to the cause of death. The immediate cause of death is stated by the attending surgeon to have been hemorrhage from a dissecting aneurism of the splenic artery. The evidence offered as to the existence of such an aneurism is exceedingly feeble. It is founded on an examination of the specimen after it had lain in alcohol. Under such circumstances laminated layers, as well as membranous precipitates are very apt to form, and on the existence of these the diagnosis appears to rest. A far more natural explanation suggests itself. Every medical student knows that when the dead subject is injected for anatomical purposes masses of blood or of the injecting material are very apt to be found in the abdominal cavity, having escaped through rents in the arteries artificially produced. The pressure used by the embalmer when injecting the President's body was so great that in several places Dr. Bliss is constrained to speak of cavities, a large part of the fluid contained in which had probably transuded from the injecting material of the embalmer. The existence of other clots in the omentum, and elsewhere in the peritoneal cavity, shows that vessels altogether unconnected with the

wound were ruptured by the injecting pressure. The autopsy should have been made before the injection, and then we should have known whether a heart-clot as an accompanying factor of death from post-pyæmic exhaustion was present or not. A physician might well blush for a profession, a member of which could in the face of the criticism waiting to hang on every expression that fell from his lips, deliberately state that the President died of "Neuralgia of the Heart."

The primary cause of death was unquestionably pyæmia. The attending surgeons persist in speaking of septicæmia, and their apologist in the *Medical Record*, Dr. Shrady, ably shields their diagnosis by saying that strictly speaking there is no such thing as pyæmia. It should be known, he claims, as metastatic septicæmia. The attending surgeons knew and know what is meant by pyæmia, and deliberately denied, and still deny, that the condition passing under that name existed. The abscess of the parotid gland, the abscess in the kidneys, and the foci in the lungs are stubborn facts; but they do not appear to exist for those who seem interested in placing their critics in the wrong.

In the conclusion of the report it is stated:—

"The surgeons assisting at the autopsy were unanimously of the opinion that, on reviewing the history of the case in connection with the autopsy, it is quite evident that the different suppurating surfaces, and especially the fractured spongy tissue of the vertebra, furnish a sufficient explanation of the septic conditions which existed during life."

This is admitted to be a correct inference by all those competent to form an opinion. Probably many will cavil at the term "especially" as destined to make light of the responsibility involved in keeping up that largest suppurating area in the President's body, the fistulous tract.

The lessons to be drawn from this surgical case, and it must be borne in mind that just such a case is reported as recovered in Dr. Hamilton's text book, are the following:—

1st. Experiments with projectiles on the dead body do not constitute any guide applicable to given living cases of gun-shot wound."

2d. Surgeons will sin less by being bold in probing and examining wounds, even when near the great cavities of the body, than by being over-conservative and taking chances.

3d. With a constitution like that of Mr. Garfield, almost any operative procedure would be preferable to a conservatism which, through its efforts to keep up a false tract, increases the fatal chances of pyæmia.

Those interested in the mechanism of the impingement of projectiles, will scarcely credit the claim that the bullet was deflected at its impinging point on the

eleventh rib. A bullet which crushes through two ribs, cuts clean through a vertebra, and penetrates altogether over eight inches of bony, muscular and fatty tissue in a straight line, and fired at so short a range, can scarcely have been deflected by the very rib it crushed to pieces. The simplest explanation of its course is, that the assassin fired at the President in a line directly continuous with the bullet track in the latter's body. That is, he fired while the plane of the President's back was oblique to the plane of the mouth of the revolver. With this the account given by the assassin himself, the coolest and most unmoved witness of the deed, is in accord throughout.

It should be recollected, what seems to have been overlooked by most or all of those who have criticized this case, that the relations of the parts into which the bullet was fired, were altogether different at the time of the assassination than when the autopsy was performed. At that time large, fatty and muscular masses had to be traversed by the ball, which, in the course of the wasting process ensuing, had nearly disappeared.

It is unfortunate that the brain was not examined. The continual delirious state of the sufferer suggests some metastatic affection of that organ. Probably the reason this organ was not examined was the desire to avoid disfigurement, but the brain can be removed in even a bald person without the latter.

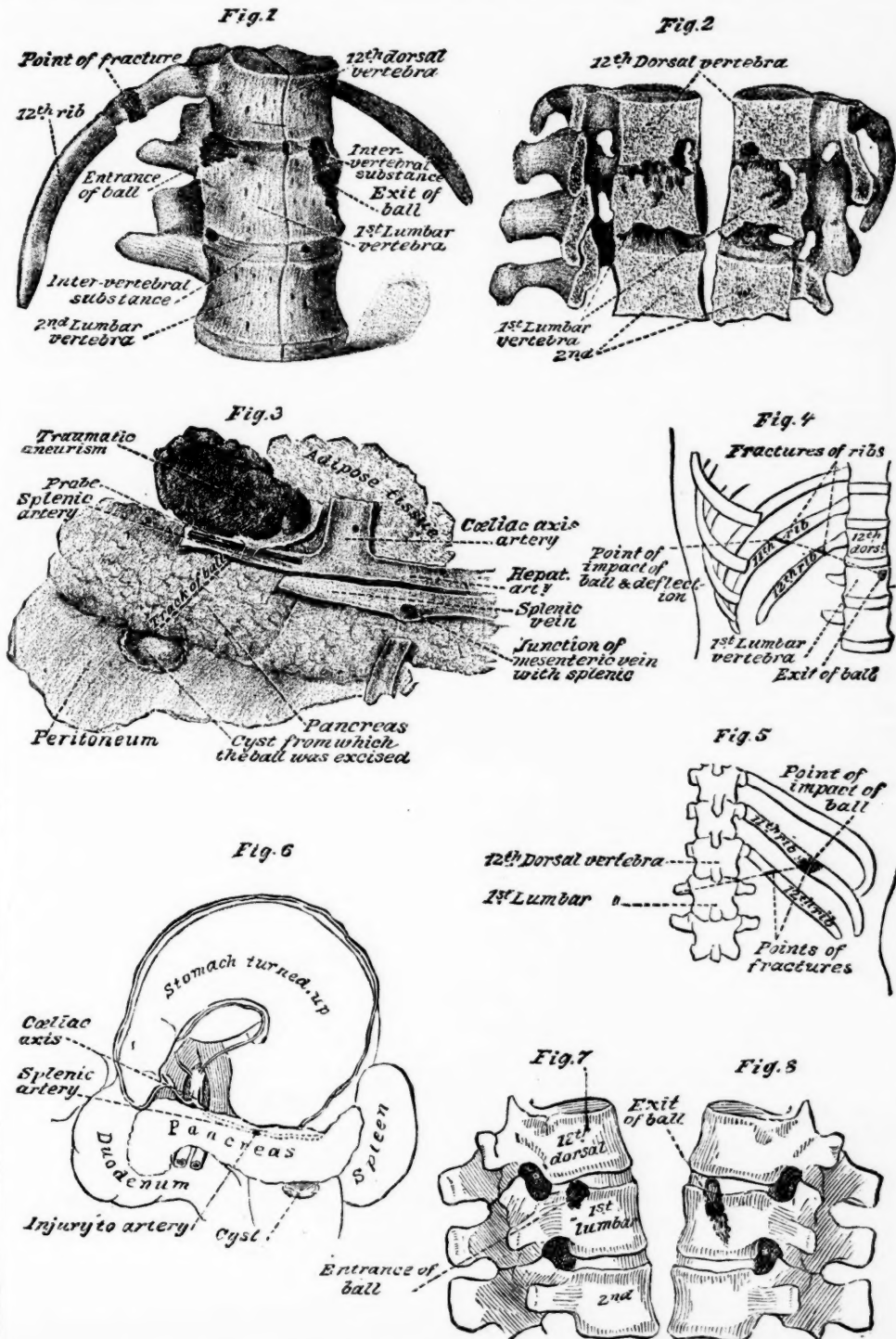
It may be here urged that the early performance of the autopsy should not have interfered with the subsequent embalming. The embalming procedure resorted to in the President's case was of the most routine and imperfect character, and not remotely comparable to the perfected processes employed by the German and Italian anatomists and embalmers.

#### REFERENCES TO OUR DIAGRAM. PAGE 499.

- P. Pancreas.
- p. p. Peritoneal cavity, the contained intestines and omental masses omitted.
- e' Vertebral entry of bullet.
- e" " exit of "
- Co. Ascending colon.
- Co. Descending colon.
- D. Extraperitoneal part of Duodenum.
- A. Aorta.
- V. Vena Cava.
- K. Kidneys.
- Sc. Spinal Cord.
- S. Spleen.

The thick straight line represents the bullet track.

PROTOPLASM STAINED WHILE LIVING.—Mr. L. F. Heneguy publishes the result of some experiments made on living infusoria, in which he confirms the observations of Brandt, made in 1879, that an aqueous solution of aniline brown, known in commerce as Bismarck brown, will give an intense brownish-yellow color to the protoplasm of the infusoria without in any way interfering with their enjoyment of life. The coloration first appears in the vacuoles of the protoplasm, then this latter is itself stained, the nucleus being most generally not at first colored, and so being made more conspicuous. Experiments made on vegetable protoplasm seemed to exhibit the same result.



DRAWINGS ILLUSTRATING AUTOPSY ON THE BODY OF THE LATE PRESIDENT GARFIELD.

## THE AMERICAN CHEMICAL SOCIETY.

The October meeting of the American Chemical Society was held Friday evening, the 7th inst., with Dr. A. R. Leeds in the chair. The following new members were declared elected: H. C. Heipe, Wm. L. Leman, Dr. H. Von Bauer, Lewis Habel, Dr. Lauber, Dr. P. Radenhausser, and Mr. A. L. Colby. The first paper announced was by Prof. Leeds "On the Comparative Purity of City Water." In consideration of the recent litigation in regard to the pollution of the water of the Passaic river, Prof. Leeds was appointed to investigate the purity of the water from a chemical standpoint. The water supply of the cities of Newark, Jersey City and Hoboken is taken from the above mentioned river. Before it reaches Newark, the sewerage of Paterson, a city of 50,000 inhabitants, is emptied into it: besides this, along the river, the stream receives the refuse from a number of factories.

A short distance beyond Paterson, at a paper mill where carbolized paper was manufactured, the entire refuse was dumped into the river. In consequence of the dissolving of the carboic acid, its presence was soon detected at Jersey City and Hoboken, and it became so objectionable that the water could not be used for drinking purposes. Legal measures were at once adopted, and the nuisance stopped. Simultaneous collection of specimens of the drinking water of the leading cities of the United States were collected, and a comparative examination of the organic matter (estimated according to the permanganate method) undertaken. Without any other special reference to the data given by Prof. Leeds, his results were as follows:—

The purity of drinking water:—

1, Brooklyn; 2, Rochester; 3, Philadelphia; 4, Baltimore; 5, New York; 6, Washington; 7, Newark, Jersey City and Hoboken; 8, Cincinnati; 9, Boston; 10, Oswego; 11, Wilmington, Del.

In answer to questions which arose during the discussion of the paper, it was stated that during the past summer an excessive amount of chlorine was found in the analysis of the Passaic river, a fact contrary to all previous experience, and one which was considered as due to the extreme drought of the past summer so diminishing the amount of fresh water that the sea water had extended quite a ways back up the river. A similar circumstance was stated in regard to the Hudson river this year, the salt water being detected higher than usual. In regard to the statements recently made by Prof. Huxley in reference to the spread of disease by germs in the water, a very significant fact was mentioned by Prof. Leeds, in commenting on the rags used in the paper mills, who stated that they were imported from the plague stricken regions of Smyrna, and yet not one case of analogous disease had been observed from those who used the water, in which these rags were cleansed, for drinking purposes. The desirable property of precipitating out organic material from water by the use of the basic chloride of iron was remarked by Dr. E. R. Squibb. This fact has been used to advantage by one of the large hotels at Coney Island.

"Upon some new Salts of Thymole Sulpho Acid, and some new facts concerning the same," was the title of the second paper. It was by Mr. James H. Stebbins, Jr., and was essentially a resumé of some recent salts prepared by him and description of their important characteristics.

The third paper was by Dr. W. Hempel, who gave in the German language a descriptive "Exhibition of some new Gas Apparatus." Not only were they exhibited, but Dr. Hempel, in the presence of the Society, made analysis of the illuminating gas (which he considers superior to that used in Europe) and of the air. To those who are especially interested in this branch his recently published book will give the requisite information, and for the average reader a general description is almost impossible without cuts.

M. B.

## MOUNDBUILDER SKELETONS.\*

I.

BY W. C. HOLBROOK, COLETA, ILL.

The skeletons found in the mounds of Rock River Valley, although always partially decomposed, present the following anatomical peculiarities:—

The *cranium* is small, low and broad. The superciliary ridges are very large and cause the forehead to appear even lower than it really is.

The malar process and the zygoma small and low.

Traces of a *frontal suture* are sometimes found in adult skulls. In the skull of a child about six years old, the suture was well developed. It appears that the two lateral portions of the frontal bone did not then unite as early in life as they now do, and that the traces of this suture remained through life in some persons. In one adult skull I found ten bones, viz.: two occipital, two parietal, two frontal, two temporal, sphenoid and ethmoid. The occipital was divided into two lateral portions by an *occipital suture*.

The *frontal suture* was also well developed. The *sagittal suture*, therefore, extended from the glabella over the vertex to the *foramen magnum*.

The *sagittal suture* is usually quite short. In one skull it measured only 4 67-100 inches, and the frontal and the occipital bones in this specimen were normal.

The supraorbital foramen is usually large and about one-eighth of an inch above the orbit. I never saw a supraorbital notch in a moundbuilder skull. *Ossa triquetra* are very uncommon and are confined to the lambdoid suture. This suture, together with traces of an occipital suture sometimes form one or two large triangular *ossa triquetra* in the superior angle of the occipital bone.

The posterior half of the synamus suture is often completely grown up and the adjacent part of the temporal and parietal bones completely united.

The grooves for the *arterie meninge media* are very deep, while the foræ that correspond to the brain are shallow and indistinct. The frontal sinus large and triangular in shape. The lower joint was large, massive and broad. The teeth are usual remarkably sound. I have never found but two or three "decayed teeth" in all of my explorations. Toothache was not, therefore, one of the troubles that beset the moundbuilders.

The humerus presents one marked peculiarity. About midway between the external and the internal condyloid ridges, and in the center of the fossa for the coronoid process of the ulna, there is sometimes a well developed foramen.

In some mounds that contained fifteen or twenty persons this foramen was found in more than fifty per cent. of the humeri. I sometimes found it in both the right and the left arms. When only present in one arm, traces of an obliterate or grown up foramen were sometimes found in the opposite arm. Traces of this foramen are quite frequent, and in all moundbuilder humeri, the flat portion of bone between the condyloid ridges are very thin. This foramen is usually small and circular. Sometimes, however, it is large and triangular in shape, the base of the triangle parallel with the trochlea and the sides parallel with the condyloid ridges. A nutritive foramen sometimes enters the lower end of the shaft of the humerus at the superior angle of this triangular foramen. I believe that the moundbuilders were slowly outgrowing this Simian characteristic, for the humeri containing the triangular foramens are found in the oldest mounds, and are associated with the lowest foreheads and the smallest crania. In both the right and the left humerus of the skeleton whose skull contained ten bones, I found this foramen well developed. In the more modern mounds this foramen is less frequently found, and when present, is small and circular. The

\* American Association for the Advancement of Science, 1881.

partition of bone between the two fossæ is also thicker.

The elimination of this "degraded affinity" is but one instance of the general evolution that has shaped or moulded all of the innumerable forms of animal and vegetable life. The vertebral column is always so badly decayed that anatomical comparison is impossible. The parts that "resist decay" indicate great physical perfection and strength. The Sacrum presents different forms in respect to curvature. Sometimes it is very slight, while in other specimens it is considerable. This curvature of the Sacrum is a more constant sexual characteristic in mound-builder skeletons than in the Caucasian or the African races, but I have not examined specimens enough to tabulate the difference. The only constant sexual characteristic of the Sacrum among all races of men is its greater breadth in the female, and this characteristic is well developed in the mound-builder skeletons. Comparing portions of almost every one of the larger bones of the mound-builder skeletons with several Caucasian and one Negro, and two Indian skeletons, it is certain that the primitive people of the Rock River Valley were strong, broad-shouldered, muscular men, with broad, round faces, and low receding foreheads. Exostosis, or foreign growth of bone, has been found. One, I remember, was found in one of the mounds near Sterling, Illinois. The foreign growth of bone in this specimen was stratified—deposited on the surface of the bone, in thin layers, like the layers in stalagmite. Bones exhumed from a mound on the west bank of Rock River, near Como, were very brittle, of a light and beautiful purplish color, when recently broken, and contained no animal matter. They resemble, in every respect, the bones exhumed from the church-yard of Ste. Genevieve, Paris, after a burial of over seven hundred years.—(Orfila Exhumations juridiques, Vol. I., p. 350.)

#### WHITE CORPUSCLES OF THE BLOOD.

The London *Lancet* draws attention to an interesting memoir on the White Corpuscles of the Blood, which appears in the part just issued of the *Archives de Physiologie*, in which M. Renault describes the different forms presented by the white corpuscles in different animals. In the river crayfish, for example, besides the ordinary lymph-corpuscles, there are many larger bodies with well defined nuclei, the protoplasm of which contains large highly refracting granules, resembling in many respects the vitelline granules of the frog and other batrachia. These corpuscles have a sharply limited but thin exoplasmic pellicle; and if a drop of such lymph be allowed to fall into a drop of a one per cent. solution of osmic acid, the white corpuscles are instantly fixed, with their pseudopodia or protoplasmic processes extended; and these processes can then be seen to perforate the thin membrane, now blackened with the acid. There are thus two kinds of white corpuscles in the decapod crustacea—the lymphoid corpuscles and the amoeboid corpuscles. Do similar differences exist in the blood of vertebrata? In reply to this, M. Renault states that in the blood of all the vertebrata, from the cyclostome to the saurians, the white corpuscles are of two kinds; one, the ordinary white corpuscle, composed of hyaline protoplasm, presenting many short projecting points, with a nucleus undergoing gemination and sending forth branched pseudopodia when placed under favorable conditions; the other containing numerous brilliant granules embedded in the protoplasm and surrounding the nucleus. These resemble the second form of corpuscle described above as existing in the lymph of the river crayfish, but differ from them in having no outer limiting layer of condensed protoplasm, or exoplasm, as Haeckel has named it. The application of osmic acid shows that they may be subdivided into two other forms: one closely analogous to cells undergoing transformation

into fat-cells, which present numerous granules, and stain black with osmic acid, and another set which contains granules that are not fatty, but which stain red with eosine. The best mode of demonstrating the existence of these three forms is to fix the blood in the rete mirabile of the capillary of the choroid in the posterior segment of the eye of a frog, by removing the anterior segment and exposing it to the vapor of osmic acid. At the expiration of twelve hours the eye is removed from the vapor, washed, the chorio-capillaris detached from the retina, and spread on glass; it is afterwards colored with, and mounted in, hæmatoxyline of eosine. The corpuscles may then be studied, and the three forms of ordinary, granular, and fatty corpuscles can be easily distinguished. M. Renault finds that the white corpuscles of mammals generally, and of man in a state of health, all closely resemble each other, and are of the ordinary kind; but in disease, as in leucocythæmia, the white corpuscles are not only greatly increased in number, but vary considerably in size. Moreover, they are round, and present no pseudopodia. They are hyaline, and have a smooth, well defined limiting membrane, and some of them have nuclei which have undergone fission, just as in a cell that is about to segment. Hence, he is of the opinion that the white corpuscles multiply and increase in number whilst floating in the blood; other corpuscles may be observed, which are charged with granules of some proteid substance, resembling vitelline granules, or small masses of hæmoglobin; and, lastly, there are still other cells, which are charged with fat. M. Renault has made some observations on the development of the red corpuscles of the lamprey, and gives the following succession of forms:—White corpuscle with nucleus proliferating, and protoplasm, not limited by an exoplasmic layer; corpuscle with nucleus proliferating, the protoplasm forming an uncolored disc, limited by an exoplasm; corpuscle with proliferating nucleus, protoplasm limited by an exoplasm, and forming a disc, more or less charged with hæmoglobin; red corpuscle with proliferating nucleus; and, finally, circular red corpuscle, with rounded nucleus.

#### MICROSCOPY.

It has been decided by the Executive Committee of the American Society of Microscopists to convene the next annual meeting of the Society at Elmira, N. Y., August 17, 1882, at 10 A. M. It is thought that there will be papers and discussions enough at Elmira to occupy us four days; thus, by adjourning Friday evening, August 20, or Saturday noon, August 21, there will be ample time—for those who wish to do so—to reach Montreal in time for the meeting of the A. A. A. of Science on Tuesday, August 24.

At the Columbus meeting Mr. E. H. Griffith, of Fairport, N. Y., a member of Executive Committee of this Society, renewed his generous offer of a prize of a Bausch & Lomb half-inch objective of 98° air angle (about 0.76 numerical aperture), to be awarded as follows:

"The prize shall be assigned to the author of the best paper on the adulteration of some important article of food or medicine. The paper shall be accompanied by permanently mounted slides, illustrating the various points under discussion; all papers and slides to become the property of the Society. The papers and accompanying studies to be in the possession of the President on the first day of the next annual meeting. He shall appoint a committee of three to examine the same, and report the name of the successful candidate before the close of the meeting. The names of the competitors shall not be made known to any member of the committee until after the award is made. The award shall not be made unless there shall be more than one competitor."

In order to carry out Mr. Griffith's instructions the following rules are established:

1. The papers and slides for the competition should be forwarded to Elmira in time to reach there before the day of the beginning of the next annual meeting, and should be addressed:

*To the President of*

THE AMERICAN SOCIETY OF MICROSCOPISTS,

Care of the Elmira Microscopical Society, Elmira, N. Y.

2. The envelopes should bear in their upper left-hand corner one of the enclosed labels, with some appropriate name or device other than the name of the author. The slides should bear the same label similarly marked (ten labels are sent with each circular).

3. Each paper should be accompanied by a sealed envelope bearing the same label and device, containing a slip with the name of the author.

4. The committee will be appointed on the first day of the Elmira meeting, and the papers and slides put into their hands. When they reach a decision, they will make a public report, stating the name or device of the successful paper. The sealed envelope bearing the same will then be opened by the President, who will announce the name of the successful author.

Persons not now members, but who shall become so at the Elmira meeting, are eligible as competitors for this prize, and can obtain the necessary labels by making application to the Secretary.

It is hoped that several papers will be received in competition for this prize which shall be found worthy of publication in the Transactions, though only one, of course, can receive the prize. The envelopes containing the names of unsuccessful competitors will not be opened except by permission of the authors, but will be destroyed by a committee appointed for that purpose.

Dr. George E. Blackham, the present President of the Society, has issued a stirring address to the members, and makes some excellent suggestions to those who would by their personal acting promote the success of the society.

Professor D. S. Kellicott of 119 Fourteenth Street, Buffalo, N. Y., is the Secretary of the Society.

#### FOSSIL POLYZOA—NOMENCLATURE.

In the second report of the committee consisting of Prof. P. M. Duncan and Mr. G. R. Vine, appointed for the purpose of reporting on Fossil Polyzoa, for the British Association, the order is divided into three subdivisions.

1. *Cheilostoma*, Bark. = *Celleporina*, Ehrenberg.

2. *Cyclostomata*, " = *Tabuliporina*, Milne-Ed., Hagenow, Johnston.

3. *Ctenostomata*, ".

The following terms are used in this Report in describing the genera:—

**ZOARIUM**.—"The composite structure formed by repeated gemmation"—Polyzoarium and Polypidom of authors.

**ZOECIUM** or cell.—"The chamber in which the Polypide is lodged.

**CENECIUM**.—"The common dermal system of a colony." Applicable alike to the "Frond," or "Polyzoary," of *Fenestella*, *Polypora*, *Phyllopora*, or *Synocladia*: or to the associated *Zoecia* and their connecting "interstitial tubuli," of *Ceripora*, *Hyphasmapora*, and *Archæopora*, or species allied to these.

**FENESTRULÆ**.—"The square, oblong, or partially rounded openings in the zoarium—connected by non-cellular dissepiments"—of *Fenestella*, *Polypora*, and species allied to these.

**FENESTRÆ** applied to similar openings, whenever connected by the general substance of the zoarium—as in *Phyllopora*, *Clathropora*, and the Permian *Synocladia*.

**BRANCHES**.—"The cell-bearing portions of the zoarium of *Glaucanome*, *Fenestella*, *Polypora*, or *Synocladia*; or the offshoots from the main stem of any species.

**GONÆCIUM**.—"A modified zoecium or cell, set apart for the purposes of reproduction."

**GONOCYST**.—"An inflation of the surface of the zoarium in which the embryos are developed." Modern terms from the Rev. Thos. Hincks.

#### "PRESERVED VEGETABLES."

By OTTO HEHNER, F. I. C., F. C. S.

When some time ago public attention was forcibly drawn to the occasional injurious effects of preserved "canned" goods, I undertook a lengthy series of chemical and physiological experiments to ascertain the cause of such poisonous action. The results having so far only been communicated to professional chemists (*The Analyst*, vol. v., No. 57), I hope you will allow me, by way of affirmation of the paragraph in *The Lancet* of September 24, to give a short summary of them, as I think they may be of interest, and of some degree of importance, to medical readers.

Very frequently the gastric disturbances traceable to the consumption of preserved articles of food have been assigned to traces of lead dissolved from the solder with which the tins are closed, or present as impurity in the metal with which the can is lined. Now, although the occasional though very rare presence of lead in such articles cannot be denied, the effects should be attributed to the tin itself. Tin, even perfectly pure, is far more readily attacked by food matters than is commonly supposed; it is to be found in comparatively large amounts in an overwhelming majority of canned goods, irrespective of the nature of the same. Acid fruits, such as peaches or cherries, corrode the tins to an appalling extent; but even meats, nay, condensed milk, dissolve and become contaminated with serious quantities of the metal.

I base my observations upon the examination of the following foods:—Vegetable: French asparagus, American asparagus, peas, tomatoes, peaches (three different brands), pine apple (two kinds), white and red cherries, and marmalade. Animal: Corned beef (five brands), ox cheek, ox tongue (three kinds), collared head, tripe, oysters, sardines in oil, salmon, salmon cutlets, lobster, shrimps, curried fowl (two kinds), boiled rabbit, boiled mutton, roast chicken, roast turkey, ox cheek soup, gravy soup, sausages, condensed milk (three brands).

With the exception of the sausages, the whole of the samples contained more or less tin, many to such an extent that abundant reactions could be obtained from two or three grammes of the vegetable substances; whilst of the animal foods one of the soups contained thirty-five milligrammes, one of the condensed milks eight milligrammes, and oysters forty-five milligrammes of tin to the pound.

Pure tin is readily attacked even by carbonic acid in solution, all samples of soda-water or of other aerated beverages which I have tested giving distinct tin reactions. Aerated beverages are generally stated to be liable to lead contamination, but seeing that lead does not enter into the composition of any of the pipes or vessels of the machines made by modern manufacturers, I do not doubt but that the black coloration produced by sulphuretted hydrogen in the beverage in question has usually been erroneously attributed to lead, and is in reality due to tin. Tin, in fact, prevents the lead passing into solution; it completely precipitates the metal from lead solutions, an equivalent quantity of tin being taken up.

The question arises, is tin, when taken into the system, injurious to health or not? Forensic literature does not furnish a positive or satisfactory reply, but the following experiments appear to me completely to settle the point.

A half-grown guinea-pig took with its ordinary food seventy-five milligrammes of pure stannous hydrate in

two doses of twenty-five and fifty milligrammes each. Death resulted under symptoms of irritant poisoning. Tin was detected in large amount in the fæces and in the viscera, notably the liver.

Another similar animal took within three days, in six doses 450 milligrammes of *stannic hydrate*, without serious effect, tin appearing abundantly in the excrements. Accustomed in a manner to stannic salts, it quickly succumbed to fifty milligrammes of stannous hydrate.

It plainly follows that while stannic compounds are not injurious in the doses given, tin in the stannous condition is a virulent irritant poison.

These experiments lead me most strongly to support your demand for a better method of packing preserved food matters than in tin canisters. Tin invariably dissolves in the stannous condition in such solvents as occur in vegetable or animal substances, and the amount of oxygen in the sealed canisters being very minute, oxidation cannot render the metal comparatively unobjectionable.

I trust that the medical profession will object, unmistakably and strongly, to the administration of tin by grocers and oilmen to young and old alike, and, whilst acknowledging the enormous benefits conferred upon the masses by the introduction of preserved foods, will insist that the present system of packing be speedily abandoned.—*Lancet*.

#### CORRESPONDENCE.

To the Editor of "SCIENCE."

DEAR SIR: I have carefully read your article on "The Warner Astronomical Prizes," published in *SCIENCE*, of Sept. 24, wherein myself and Mr. Warner, are severely and unjustly criticised. In a former number you had criticised one of the conditions of the prize: viz, that "the comet must be telescopic and unexpected," saying that a person might discover a comet by the aid of an opera glass. But what, I ask, is an opera glass but a telescope. In order to defend myself from even the semblance of crookedness, allow me to state a few facts, familiarity with which would, doubtless, have kept you from error. When the great comet (known as comet B) made its appearance so suddenly, all familiar with the conditions of the award, conceded that no just demand on Mr. Warner could be made, as it was neither telescopic nor unexpected, but very many people, not conversant with the conditions, and supposing that it applied to all comets, began to send in claims for discovery. Then Mr. Warner said, inasmuch as the comet was such a large and brilliant one, and that so many seemed not to have understood the conditions imposed, he would offer a *special* prize of \$200 to the one whom I, after an examination of claims, should decide had first seen it. It is a point of no little significance, to remember that this in no sense was to be considered as the Warner-prize proper to be adjudicated upon by Profs. Hall and Young, in the event of a controversy, but was distinctly stated to be a *special* prize. The conditions of the original prize were neither in this, nor any other instance, to be deviated from. From a misconception of this vital point, which, under the circumstances, was, perhaps, natural, you have endeavored to make your readers believe that Mr. Warner took—wrongfully and unjustly—the matter out of the hands of Profs. Hall and Young, and placed it in my own, but you are grievously in error. I do not purpose to burden your columns with the reasons for not awarding the prize for comet B. Not an astronomer in the world, with all those letters before him, would have awarded it.

You make the task of deciding the question a very easy

one, and so might I have found it by placing myself in the position of a judge, who must decide according to the evidence, true or false. Instead of condensing the letters to a half dozen, as you suggest, I could have reduced them to a single one, for one of the claimants solemnly declared that he saw it a year ago last August, and that he had watched it ever since, while another averred that he discovered it last January, and several claimed it before its discovery in South Africa, and some of these statements were sworn to at that.

Every astronomer knows that the comet (which was discovered in South Africa on May 21), in its northward journey, passed the sun, 8° west of it, at noon on the 19th of June, and, therefore, after its disappearance in the southern hemisphere, could not have been seen by any person, in any part of the world, before the morning of the 22d of June, and yet not less than 1000 persons claimed (the statements of many being substantiated by affidavits), that they saw the comet at dates ranging all the way from May 1 to June 20. Was I to accept such statements as those, and accord to them the dignity of evidence, and award the prize for an invisible comet? The comet first became visible to us near the time of the summer solstice, when twilight commenced at about half past two A. M., which rendered even a bright and expected comet very difficult to see until its declination north became at least 15° greater than the sun's. Your assertion that I have awarded myself the prize for the discovery of one comet, is erroneous to the last degree. Where there is but one claimant, as was the case with Swift's, with Schaeberle's, and with Barnard's comets, Mr. Warner, without consultation with any one, pays the prize. Should any dispute arise as to priority of discovery, &c., then, according to the conditions, the matter was to be left to Profs. Hall and Young for a decision.

Again, you do me great injustice in saying that the essays ought not to be filed with me, because I am both a competitor and a judge. I am not a competitor for that prize, nor am I to be a judge. The essays are placed in my hands for safe keeping, and when the first of November arrives, will three astronomers (if as many can be found who are not competitors) be appointed as judges, to whom I shall send the essays for a decision agreeably to condition. 3d. As to who will appoint the judges, I am as ignorant as you are.

Trusting you will give this letter in its entirety, to the public, through the columns of your journal, I remain,  
Yours truly, LEWIS SWIFT.

ROCHESTER, October 10, 1881.

RELATIONS BETWEEN THE CRANIUM AND THE REST OF THE SKELETON.—These relations form the subject of a paper by M. Manouvrier, read at the last meeting of the French Association. The following are the author's conclusions:—

1. The weight of the cranium varies, in a general way, with the weight of the skeleton, but not proportionally, like the weight of the brain.
2. The weight of the skeleton, less the cranium, in a given race, varies nearly in proportion to the weight of the femur.
3. The weight of the cranium is greater relatively to that of the femur, the lighter the latter is.
4. The weight of the cranium is much more considerable relatively to that of the femur in woman than in man.
5. This sexual difference is so pronounced that it constitutes one of the best secondary sexual characters. About 82 women in 100 have the cranium heavier than the two femurs, while 82 men in 100 have it lighter.
6. The lower jaw is heavier relatively to the cranium in the anthropoids than in man, is inferior than in civilized races, in man than in woman, and in the adult than in the child.
7. The weight of the cranium is smaller relatively to that of the lower jaw, the heavier the latter is, etc.

## NOTES AND QUERIES.

**ELECTRICITY.**—I wish to inquire if it has been determined whether upon the union of two currents of electricity of different electromotive forces, they form one current of an intermediate intensity, as two streams of water of different temperatures would form one of an intermediate temperature. Or, whether they each retain its own E. F. M., and follow the terms of its own intensity. And, if the problem has been determined, where I can find the particulars.

And, further, if the two retain their separate identities, whether any instrument has been made to measure the different quantities and intensities which pass in a single conductor.

This is a very important question in view of the great practical problems which we have now to solve in regard to the production and use of electricity.

SAML. J. WALLACE.

**THE COLOR CHANGES OF AXOLOTL.**—Prof. Semper has lately examined axolotl with regard to the influence of light on its color (*Würzburg Phys. med. Ges.*). When young axolotl are reared in darkness they become quite dark; nearly as dark in red light; in yellow, on the other hand, pretty bright; and brightest in bright daylight. The difference is connected not only with the chromatic function found in various degrees in all amphibia, but on pronounced formation of a peculiar diffuse yellowish green coloring matter, increase of white, and diminution of dark chromatophores. Further, when axolotl are exposed to daylight in white dishes covered with white paper, much less dark pigment forms in them than when they are kept in white dishes without a paper cover (other things equal); though in the latter case

they are apparently exposed to the most intense light; these darker axolotl are, however, still much brighter than those reared in red light or in darkness. Since (as experiment showed) the white covering paper let through much light, but very little of the chemical rays, it appears that chemical rays play no part in the formation of pigment. But the causes of the whitening in bright daylight and the darkening in absence of light remain unknown as before.

**THE BLOOD OF INSECTS.**—Operating with the larva of *Oryctes nasicornis*, M. Fredericq has observed (*Bull. Belg. Acad.*) that the blood of the animal, drawn off in a small glass cannula, is a colorless liquid, but on exposure to the air presently takes a decided brown color, and coagulates. The coloration he regards as a purely cadaveric phenomenon. The substance which becomes brown is probably formed in the moment of coagulation, and does not serve in the body as a vehicle between the external air and the tissues, like *hemoglobin* in Vertebrates and many Annelids, *hemocyanin* in Crustaceans, &c. When the larva is kept a quarter of an hour in hot water (50° to 55°), the blood extracted does not coagulate or become brown. Once the substance which browns is produced, even a boiling temperature does not prevent its browning. The brown substance once formed is very stable, not being decomposed either by acids or alkalis, and not made colorless by being submitted to vacuum or kept in a closed vessel. The existence of an intermediary in insects corresponding to *hemoglobin* M. Fredericq thinks very problematical in view of the anatomical system, letting air penetrate into the heart of the tissues.

## METEOROLOGICAL REPORT FOR NEW YORK CITY FOR THE WEEK ENDING OCT. 15, 1881.

Latitude 40° 45' 58" N.; Longitude 73° 57' 58" W.; height of instruments above the ground, 53 feet; above the sea, 97 feet; by self-recording instruments.

BAROMETER.										THERMOMETERS.																													
OCTOBER.	MEAN FOR THE DAY.		MAXIMUM.		MINIMUM.		MEAN.		MAXIMUM.				MINIMUM.				MAXIMUM.																						
	Reduced to Freezing.	Reduced to Freezing.	Time.	Reduced to Freezing.	Time.	Dry Bulb.	Wet Bulb.	Dry Bulb.	Time.	Wet Bulb.	Time.	Dry Bulb.	Time.	Wet Bulb.	Time.																								
Sunday, 9.	29.899	29.900	9 a. m.	29.862	3 a. m.	63.3	59.6	71	0 a. m.	64	10 a. m.	55	12 p. m.	55	12 p. m.	100.																							
Monday, 10.	30.069	30.324	12 p. m.	29.900	0 a. m.	54.6	49.3	64	2 p. m.	55	12 m.	41	12 p. m.	40	12 p. m.	128.																							
Tuesday, 11.	30.426	30.478	9 a. m.	30.324	0 a. m.	44.7	41.7	51	5 p. m.	47	5 p. m.	37	5 a. m.	37	7 a. m.	119.																							
Wednesday, 12.	30.179	30.396	0 a. m.	30.096	12 p. m.	54.0	52.0	57	2 p. m.	55	3 p. m.	44	2 a. m.	41	2 a. m.	92.																							
Thursday, 13.	29.968	30.096	0 a. m.	29.908	4 p. m.	65.7	62.3	73	4 p. m.	67	4 p. m.	55	6 a. m.	55	6 a. m.	130.																							
Friday, 14.	30.239	30.298	0 a. m.	30.000	0 a. m.	50.0	46.6	60	0 a. m.	57	0 a. m.	45	8 a. m.	43	8 a. m.	120.																							
Saturday, 15.	30.035	30.244	0 a. m.	30.006	12 p. m.	62.0	58.3	69	3 p. m.	63	4 p. m.	50	0 a. m.	48	0 a. m.	121.																							
Mean for the week.....										30.123 inches.										Dry.																			
Maximum for the week at 9 a. m., Oct. 11th.....										30.478 "										56.3 degrees.....										Wet.									
Minimum " at 3 p. m., Oct. 9th.....										29.852 "										73. " at 4 p. m. 13th, 67. "										5 a. m. 11th, 37. "									
Range.....										.615 "										36. "										30. "									
WIND.						HYGROMETER.						CLOUDS.				RAIN AND SNOW				OZONE.																			
OCTOBER.	DIRECTION.			VELOCITY IN MILES.		FORCE IN LBS. PER SQ. FEET.		FORCE OF VAPOR.		RELATIVE HUMIDITY.		CLEAR, OVERCAST.			DEPTH OF RAIN AND SNOW IN INCHES.																								
	7 a. m.	2 p. m.	9 p. m.	Distance for the Day.	Max.	Time.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	Time of Beginning.	Time of Ending.	Duration, h. m.	Amount of water.																				
Sunday, 9.	n. w.	n. w. w.	n. w. w.	133	1/2	1.00 am	.509	.438	.449	74	68	100	8 cu.	9 cu.	0	.....	.....	.....	.....																				
Monday, 10.	n.	n. n. w.	n. n. w.	242	7	3.40 pm	.321	.285	.251	74	48	84	0	3 cu.	0	0.30 pm	5.00 pm	4.30	.19																				
Tuesday, 11.	n. e.	n. e.	s. s. e.	240	6 1/2	0.15 am	.207	.199	.273	90	57	85	0	0	0	.....	.....	.....	.....																				
Wednesday, 12.	s. w.	s.	w. s. w.	158	4 1/2	1.50 pm	.297	.378	.420	85	81	93	0 cu.	10	10	.....	.....	.....	.....																				
Thursday, 13.	w. s. w.	w. s. w.	w.	146	8 1/2	9.00 pm	.420	.559	.599	93	71	84	6 cir. cu.	8 cu.	10	0.15 pm	4.00 pm	3.45	.09																				
Friday, 14.	n. e.	e.	s. e.	198	4	9.10 am	.249	.257	358	77	66	79	0	0	5 cu.	.....	.....	.....	.....																				
Saturday, 15.	s. s. w.	s. s. w.	s. s. w.	197	3 1/2	10.20 pm	.349	.457	.529	80	69	89	10	1 cu. s.	0	.....	.....	.....	.....																				
Distance traveled during the week.....										1,314 miles.										Total amount of water for the week.....										.28 inch.									
Maximum force.....										8 1/2 lbs.										Duration of rain.....										8 hours, 15 minutes.									

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